BACKGROUND

In India as also in many other developing countries, food accounts for a large part of the family budget. Every consumer wants to get the maximum quantity of a commodity for as low a price as possible. This attitude of the consumers being coupled with the intention of the traders as well as the manufacturer to increase the margin of a profit as high as the variable market demand permits generates a vicious circle where the quality of the commodity gets reduced through addition of baser substances and/or removal of vital elements, and the process is defined as adulteration.

The Prevention of Food Adulteration Act, passed in 1954 came into force from 1st June, 1955. Successive amendments have been made to this Act to plug the loopholes and to make it more effective. But in spite of several measures adopted for enforcement of the Act and agencies as well as institutions created to put an end to this nefarious practice, the wilful act on the part of the adulterators could not be checked to the desired extent and instead went on increasing the ingenuity of the adulterators who tried all possible and impossible adulterants and left no food unadulterated.

The science activists from various voluntary organisations have in recent years started building awareness among the people by way of demonstrating detection of food adulteration. The students from at different levels under the guidance of their teachers have also begun to participate in

championing the campaign. The mass media like television, radio and newspapers have taken up the issue to build a public awareness.

The movement, thus generated, is still in its infancy and has over the years spread in a very diffused way. In order to intensify the acceleration of this movement in a well organised manner and with higher order of functionality, it has been felt necessary to evolve a Food Adulteration Detection Manual in a simple language and with greater precision for the benefit of the demonstrators and for the advantage of the people who intend to acquire the capability of detecting food adulteration. Keeping this need in view, a Food Adulteration Detection Manual is prepared and presented to add a momentum to the movement generated and to galvanise the process of prevention of food adulteration for providing a protection to human health and environment.

This MANUAL is a product of experiences of the science activists of Science Communicators' Forum and Action Research Institute who have regularly been conducting food adulteration detection camps and campaigns to create a public awareness as well as to enable the people to organise and express a people's concern. In course of time, a Food Adulteration Kit has also been developed and some visuals have been prepared to augment the process.

Acknowledgement is made to the people who have subscribed to the cause and to the food technologists who have provided this movement with all relevant and technical information.

PHYSICAL TEST

Food: Tea leaves

Adulterant: Iron flakes

Detection: Spread a small quantity (2 tea-spoon) of the sample on a piece of paper. Draw a magnet over it. Iron flakes, if present, cling to the magnet. The same test may be carried out to trace iron flakes from tea half-dust and iron filngs from tea dust.

Food: Tea leaves

Adulterant: Leather flakes

Detection: Prepare a paper-ball. Fire the ball and drop a little amount of the sample on it. The presence of leather flakes emits an odour of burnt leather.

Food: Tea leaves

Adulterant: Coal tar dye

Detection: Scatter a little amount (1 tea-spoon) of the sample on a moistened white blotting paper. After 5 minutes, remove the sample and examine the paper. A revelation of coloured spots indicates the use of the dye.

Food: Coriander power and Cumin powder

Adulterant: Saw dust

Detection: Take a little amount (a half of a tea-spoon) of the sample. Sprinkle it on water in a bowl. Spice powder gets sedimented at the bottom and saw-dust floats on the surface.

Food: Green vegetables like bitter gourd, green chilli and others

Adulterant: Malachite green

Detection: Take a small part of the sample and place it on a peice of moistened white blotting paper. The impression of colour on the paper indicates the use of malachite green, or any other low priced artificial colour.

Food: Arhar pulse

Adulterant: Kesarri pulse

Detection : Kesari pulse has a characteristic wedge shape. Larger kesari resembles arhar (tur.) It can be separated by visual examination.

Food: Black pepper

Adulterant: Papaya seeds

Detection: Papaya seeds do not have any smell and are relatively smaller in size. Adulteration of papaya seed with black pepper may be detected by way of visual examination as also by way of smelling.

Food: Rice

Adulterant: Earth, sand, grit, unhusked paddy, rice bran, talc, etc.

Detection: These adulterants may be detected visually and removed by way of sorting, picking and washing.

Food: Wheat

Adulterant: Earth, sand, girt, chopped straw, bran, unhusked grain and seeds of weeds.

Detection: These adulterants may be detected visually and removed by way of sorting, picking and washing.

CHEMICAL TEST

Food: Coffee powder

Adulterant: Cereal starch

Detection: Take a small quantity (one-fourth of a tea-spoon) of the sample in a test tube and add 3 ml of distilled water in it. Light a spirit lamp and heat the contents to colourize. Add 33 ml of a solution of potassium permanganate and muratic acid (1:1) to decolourize the mixture. The formation of blue colour in mixture by addition of a drop of 1% aqueous solution of iodine indicates adulteration with starch.

Food: Coffee powder

Adulterant: Powder of scorched persimmon stones

Detection: Take a small quantity (1 tea-spoon) of the sample and spread it on a moistened blotting paper. Pour on it, with much care, 3 ml of 2% aqueous solution of sodium carbonate. A red coluration indicates the presence of powder of scorched persimmon stones in coffee powder.

Food: Jaggery

Adulterant: Sodium bicarbonate

Detection: Take a little amount (one-fourth of a tea-spoon) of the sample in a test tube. Add 3 ml of muratic acid. The presence of sodium caronate or sodium bicarbonate effects effervescence.

Food: Jaggery

Adulterant: Metanil yellow colour

Detection: Take a little amount (one-fourth of a tea-spoon) of the sample in a test tube. Add 3 ml of alcohol and shake the tube vigourously to mix up the contents. Pour 10 drops of hydrochloric acid in it. A pink colouration indicates the presence of metanil yellow colour in jaggery.

Food: Asafoetida

Adulterant: Resin and colour

Detection: Take a little amount of small parts of the sample in test tube. Add 3 ml of distilled water and shake the tube gently. Pure asafoetida dissolves in water very quickly and produces a milky white colour, but in case of adulteration with a chemical colour the mixture turns to be coloured. The purity of asafoetida may also be examined by taking a little amount of it on the tip of a forcep and placing the same on the flame of a spirit lamp. Asafoetida burns quickly, producing bright flame and leaving the impurities behind.

Food: Gram powder

Adulterant: Kesari powder

Detection: Take a little amount (a half of a tea-spoon) of the sample in a test tube with 3 ml of distilled water. Add 3 ml of muratic acid. Immerse the tube in warm water. Check the tube after 15 minutes. A violet colouration indicates the presence of kesari powder in gram powder.

Food: Gram powder

Adulterant: Metanil yellow colour

Detection: Take a small quantity (a half of a tea-spoon) of the sample in a test tube. Add 3 ml of alcohol. Shake the tube to mix up the contents thoroughly. Add 10 drops of hydrochloric acid in it. A pink colouration indicates adulteration of gram powder with metanil yellow.

Food: Processed food, sweetmeat, or syrup

Adulterant: Rhodamine B colour

Detection: The presence of this chemical colour in food is very easy to detect as it shines very brightly under sun. A more precise methods of detection is also there. Take a little amount (a half of a tea-spoon) of the sample in a test tube. Add 3 ml of carbon tetrachloride and shake the tube to mix up the contents thoroughly. The mixture becomes colourless and an addition of a drop of hydrochloric acid brings the colour back when food contains rhodamine B colour.

Food: Processed food, sweetmeat, or syrup

Adulterant: Metanil yellow

Detection: Take little amount (a half of a tea-spoon) of the sample in a test tube. Add 10 drops of muratic acid or hydrochloric acid in it. The appearance of rosy colour indicates adulteration of food with metanil yellow.

Food: Parched rice

Adulterant: Urea

Detection: Take 30 pieces of parched rice in a test tube. Add 5 ml of distilled water. Shake the tube to mix up the contents thoroughly. After 5 minutes, filter water contents and add to

it a little amount (a half of a tea-spoon) of powder of arhar or soyabean. Wait for another 5 minutes and then dip a red litmus paper in the mixture. Lift the paper after 30 seconds and examine it. A blue colouration indicates the use of urea in parched rice.

Food: Turmeric powder

Adulterant: Metanil yellow colour

Detection: Take a little amount (one-fourth of a tea-spoon) of the sample in a test tube. Add 3 ml of alcohol. Shake the tube to mix up the contents thoroughly. Add 10 drops of muratic acid or hydrochloric acid in it. A pink colouration indicates the use of metanil yellow colour in turmeric powder.

Food: Green vegetable like green chilli, etc.

Adulterant: Malachite green

Detection: Rub the outer green surface of a small part of the sample with a liquid paraffin soaked cotton. The sample is adulterated when the white cotton turns green.

Food: Dry red chilli

Adulterant: Rhodamine B colour

Detection: Take a red chilli from the sample and rub the outer surface with a piece of cotton soaked in liquied paraffin. The sample is adulteated if the cotton becomes red.

Food: Dry turmeric root

Adulterant: Metanil yellow colour

Detection: Take a piece of dry turmeric root and rub the outer surface with a peice of cotton soaked in liquid paraffin. A yellow colouration of cotton indicates adulteration of turmeric root with metanil yellow colour.

Food: Sweet potato

Adulterant: Rhodamine B colour

Detection: Take a small part of the sample and rub the red outer surface with a piece of cotton soaked in liquid paraffin.

The cotton adhering colour indicates the use of rhodamine B colour on outer surface of the sweet potato.

Food: Red chilli powder

Adulterant: Rhodamine B Colour

Detection: Take a little amount (one-fourth of a tea-spoon) of the sample in a test tube. Add in it 3 ml of distilled water and 10 drops of carbon tetrachloride. Shake the tube vigorously to mix up the contents. The disappearance of red colour as a result of the shake and reappearance of the same colour after addition of a drop of hydrochloric acid indicate the use of rhodamine B colour in red chilli powder.

Food: Mustard oil

Adulterant: Argemone oil

Detection: Take a little amount (3ml) of the sample in a test tube. Add 20 drops of nitric acid. Heat the tube on the flame of a spirit lamp for 3 minutes. A red colouration indicates the presence of argemone oil in mustard oil.

Food: Mustard oil

Adulterant: Cotton seed oil

Detection: Take a small quantity (3 ml) of the sample in a test tube. Add in it 2 ml of amyl alcohol, 1 ml of carbon disulphide and a little amount of sulphur. Plug the mouth of the test tube and heat the tube on the flame of a spirit lamp for 3 minutes. A red colouration indicates the presence of cotton seed oil in mustard oil.

Food: Mustard oil

Adulterant: Mineral oil

Detection: Take a little amount (3 ml) of the sample in a test tube. Add 20 drops of alcholic potash. Heat the tube on the flame of a spirit lamp for 3 minutes to effect decolourization of the mixture. Add 10 drops of distilled water and shake the tube. Examine the tube to trace turbidity. Continue the operation of adding water upto 15 ml and the examination of

the tube for appearance of turbidity. The appearance of turbidity indicates the presence of mineral oil in mustard oil.

Food: Mustard oil

Adulterant: Castor oil

Detection: Take a little amount (3 ml) of the sample in a test tube. Add 2 ml of petroleum ether. Shake the tube to mix up the contents thoroughly. Keep the tube immersed in a salt-ice mixture or in a pot of cold saline water. Examine the tube after 5 minutes. The apperance of turbidity in mixture indicates the presence of castor oil in mustard oil. A similar test may be made to detect adulteration of mustard oil with coconut oil, or dalda.

Food: Edible oil

Adulterant: Prohibited colour

Detection: Take a little amount (20 drops) of the sample in each of 4 test tubes. Prepare 3 different solutions, mixing up 1 part of distilled water, 3 parts of distilled water and 4 parts of distilled water. Add 2 ml of each solution in each of 3 test tubes and add 2 ml of hydrochloric acid in the fourth test tube. Shake each tube to mix up the contents thoroughtly. A rosy colouration in the mixture of any tube indicates the presence of prohibited colour in edible oil.

Food: Edible oil

Adulterant: Cyanide

Detection: Take a little amount (3 ml) of the sample in a test tube. Add 10 drops of alcoholic potash and heat the tube on the flame of a spirit lamp. Make an addition of a little amount of each of ferrorus sulphate and ferric chloride in the test tube and shake it to mix up the contents thoroughly. Add 3 ml of hydro-chloric acid. A blue colouration indicates the presence of hydrocyanic acid which gets produced due to presence of cyanide in edible oil.

Food: Edible oil

Adulterant: Mobil oil

Detection: Take a little amount (20 drops) of the sample in a test tube. Add 10 drops of alcoholic potash. Heat the tube on the flame of a spirit lamp to decolourize the mixture. Add 10 drops of dichloroquinol chloride. Heat the tube again. The appearance of blue colour indicates the presence of a compound of triorthocrysyle phosphate (TOCP) which contributes to incidence of paralysis. Traces of this compound in edible oil point to an admixture of edible oil with mobil oil.

Food: Edible oil

Adulterant: Rancidity

Detection: Take a little amount (3 ml) of the sample in a test tube. Add in it 3 ml of hydrocholoric acid. Plug the mouth of the test tube. Shake the tube to mix up the contents thoroughly. Add 3 ml of 0.1% phloroglucinol solution in ether. Shake the tube vigorously for 2 minutes and keep it aside. Examine the tube after half an hour. A red or pink colouration in acid layer indicates that the oil sample is rancid.

Food: Soda lemonade

Adulterant: Mineral acid

Detection: Pour 2 drops of the sample on a metanil yellow paper strip. A violet colouration indicates the presence of mineral acid in aerated water. The colour impression gets retained even after drying the paper. (Prepare metanil yellow paper strips by soaking filter paper strips in 0.1% aqueous solution and drying the paper strips).

Food: Milk

Adulterant: Sodium bicarbonate

Detection: Take a little amount (3 ml) of the sample in a test tube. Add 10 drops of rosalic acid solution. A rosy colouration indicates the presence of sodium bicarbonate in milk.

Food: Milk

Adulterant: Glucose

Detection: Take a little amount (5 ml) of the sample in a test tube. Dip a strip of diastix in it for half a minute. A change in colouration from blue to green indicates the presence of glucose in milk.

Food: Milk

Adulterant: Sugar

Detection: Take a little amount (3 ml) of the sample in a test tube. Add in it 2 ml of hydrochloric acid or muratic acid. Heat the tube after adding a bit (50 mg) of resorcinol. A red colouration indicates the use of sugar in milk. The detection may be made by a different test. Take a small amount (5 ml) of the sample in a test tube. Add a little amount (1 mg) of invertase enzyme. After 5 minutes, dip a strip of diastix in it. Lift the strip after half a minute. A change in colour from blue to green indicates the use of sugar in milk.

Food: Milk

Adulterant: Cereal starch

Detection: Take a little amount (3 ml) of the sample in a test tube. Add a drop of 1% aqueous solution of iodine. A blue or deep blue colouration indicates the use of cereal starch in milk.

Food: Milk

Adulterant: Urea

Detection : Take a little amount (5 ml) of the sample in a test tube. Add a little amount (a half of a tea-spoon) of soyabean or arhar powder. Shake the tube to mix up the contents thoroughly. After 5 minutes, dip a red litmus paper in it. Lift the paper after 30 seconds. A change in colour from red to blue indicates the use of urea in milk.

Food: Milk

Adulterant: Take a little amount (3 ml) of the sample in a test tube. Add 20 drops of hydrochloric acid and shake the tube

to mix up the contents thoroughly. Dip a yellow paper strip and lift the same after a minute. A change in colour from yellow to red followed by a change from red to green by addition of drop of ammonia solution indicates the presence of boric acid in milk. (To prepare yellow paper strips, dip strips of filter paper in an aqueous solution of turmeric and dry it up).

Food: Milk

Adulterant: Dalda

Detection: Take a little amount (3 ml) of the sample in a test tube. Add 10 drops of hydrochloric acid or muratic acid. Mix up a little amount (one-fourth of a tea-spoon) of sugar. Examine the mixture after 5 minutes. A red colouration indicates the use of dalda in milk.

Food: Sweet curd

Adulterant: Dalda

Detection: Take a little amount (5 ml) of the sample in a test tube. Add 10 drops of hydrocholoric acid or muratic acid. Shake the tube gently to mix up the contents. Examine the mixture after 5 minutes. A red colouration indicates the use of dalda in sweet curd.

Food: Rabri, a sweetmeat prepared by condensing the films of milk

Adulterant: Blotting paper

Detection: Take a small quantity (1 tea-spoon) of the sample in a test tube. Add 3 ml of hydrochloric acid or murateic acid and 3 ml of distilled water. Stir the contents with a glass rod. Lift the rod and examine. Adherence of finer fibres to the rod indicates the presence of blotting paper in rabri.

Food: Ghee

Adulterant: Dalda

Detection: Take a little amount (3 ml) of the sample in a test tube. Add 10 drops of hydrochloric acid or muratic acid and

a little amount (one-fourth of a tea-spoon) of sugar. Shake the tube to mix up the contents thoroughly. Examine the tube after 5 minutes. A red colouration indicates the presence of dalda in ghee.

In building an awareness among the people as to the nature and extent of food adulteration and in developing a strong public opinion in favour of strict enforcement of Food Adulteration Prevention Act and other control measures adopted subsequently, the science activists as well as the students from at different levels may exhibit to the people varieties of adulterated food, conduct tests on detection of adulteration, explain the results there of and project the harmful effects of the adulterants on erosion of human life and its environment. The food samples may locally be collected, but if it becomes difficult for a demonstrator to go round for collection of samples of different kinds of food from shops and establishments located at differnt sites he may make use of the Food Adulteration Kit (developed by Science Communicator's Forum and Action Research Institute) wherein an incorporation is made of the following food-samples:

1. Adulterated tea leaves
2. Adulterated half-dust tea
3. Adulterated tea dust
4. Adulterated coriander powder
5. Adulterated cumin powder
6. Adulterated lady's finger
7. Adulterated arhar pulse
8. Adulterated black pepper
9. Adulterated rice grain
10. Adulterated wheat grain
11. Cereal starch in coffee
12. Persimmon stone powder in coffee

13. Adulterated jaggery
14. Adulterated asafoetida
15. Adulterated gram powder
16. Adulterated parched rice
17. Adulterated turmeric powder
18. Adulterated red chilli
19. Adulterated turmeric root
20. Adulterated sweet potato
21. Adulterated red chilli powder
22. Soda in milk
23. Glucose in milk
24. Sugar in milk
25. Wheat-flour in milk
26. Urea in milk
27. Boric acid in milk
28. Rhodamine B in syrup
29. Metanil yellow in syrup
30. Castor oil in mustard oil
31. Dalda in mustard oil
32. Coconut oil in mustard oil
33. Colour in mustard oil
34. Dalda in ghee

In determination of food adulteration, some materials (chemicals, etc.) are used as detectors which may be purchased from local market or may be had from the KIT referred to. The detectors as supplied in the kit include-

1. Potassium permanganate
2. Muratic acid
3. Iodine solution

4. Sodium carbonate solution
5. Alcohol
6. Hydrochloric acid
7. Carbon tetrachloride
8. Soyabean powder
9. Red litmus paper
10. Phenolphthalein solution
11. Liquid paraffin
12. Nitric acid
13. Amyl alcohol
14. Carbon disulphide
15. Sulphur
16. Alcoholic potash
17. Petroleum ether
18. Ferrous sulphate
19. Ferric chloride
20. Metanil yellow paper strip
21. Diastix
22. Yellow paper strip
23. Ammonia solution
24. Sugar

In conducting a demonstration on food adulteration detection, some additional materials like test tube, etc. are required, and these do not come under either category of food samples or detectors but facilitate the process of detection as accessories which may be purchased locally or may be had from the kit referred to. The accessories as incorporated in the kit are-

1. Test tube
2. Spirit lamp

3. Rectified spirit
4. Distilled water
5. Blotting Paper
6. Waste paper
7. Cotton
8. Cork
9. Plate
10. Bowl
11. Spoon
12. Magnet
13. Tongs
14. Filter paper
15. Napkin
16. Test tube holder
17. Dropper
18. Match box
19. Glass rod

The demonstration of food adulteration detection in an exhibition, fair or at an organised public show will be attractive and effective if the samples of adulterated food materials and their adulterants are displayed side by side. It will be much more communicative and exert greater impact on the audience if charts and posters displying adverse and injurious effects of different adulterants on growth and maintenance of good health are projected . Such visuals may be designed locally or may be had from this working team which has prepared the MANUAL and organised the KIT.

A smaller kit has also been developed for the student activists who may make use of the said kit under cocurricular activities.